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Lee et al.

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(54) **DEVICE FOR DATA COMMUNICATIONS BETWEEN WIRELESS APPLICATION PROTOCOL TERMINAL AND WIRELESS APPLICATION SERVER, AND METHOD THEREOF**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**[7] **G09G 5/00**
(52) **U.S. Cl.** **370/401**; 370/410
(58) **Field of Search** 370/310, 315, 370/328, 338, 352, 353, 354, 355, 356, 401, 410, 465, 466, 467; 709/203, 227, 238

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Contribution to WAP Forum WPG on WAP over CDMA IS–707 CSD; Jul. 20, 1998; pp. 1–6 and pp. 1–2.

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(57) **ABSTRACT**

A device for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server, and a data communication method thereof. The data communications device includes: a plurality of WAP terminals each having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, for generating WAP data which is service request data; a plurality of WAP servers each having a protocol stack in which a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under a WTP layer and a WDP layer, for providing the WAP terminals with WAP server data according to the WAP data; and an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, for mapping the WAP terminals to the corresponding WAP servers, wherein each WAP terminal communicates with the IWF unit though a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer included in its own CSD protocol layer, and the IWF unit communicates through the Internet with each WAP server. Because there is no redundancy of IP/PPP protocol layers in the WAP terminal, overhead is considerably reduced. Also, the IWF unit is directly connected through the Internet to the WAP server, not through the PSTN and the ISP, so that connection time and costs can be reduced.

4 Claims, 6 Drawing Sheets

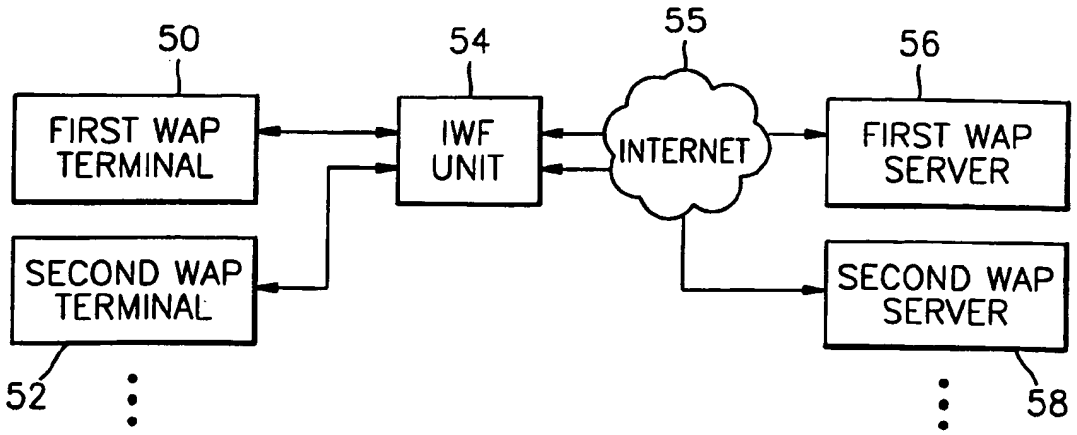


FIG. 1 (PRIOR ART)

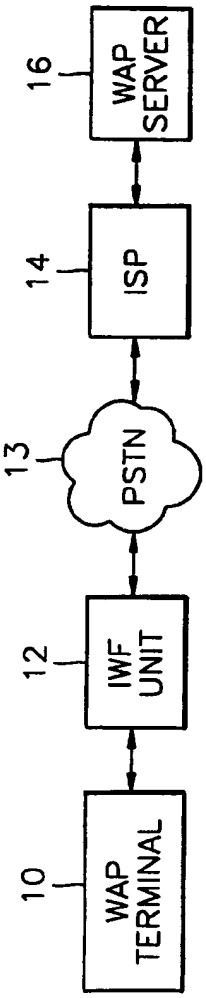


FIG. 2 (PRIOR ART)

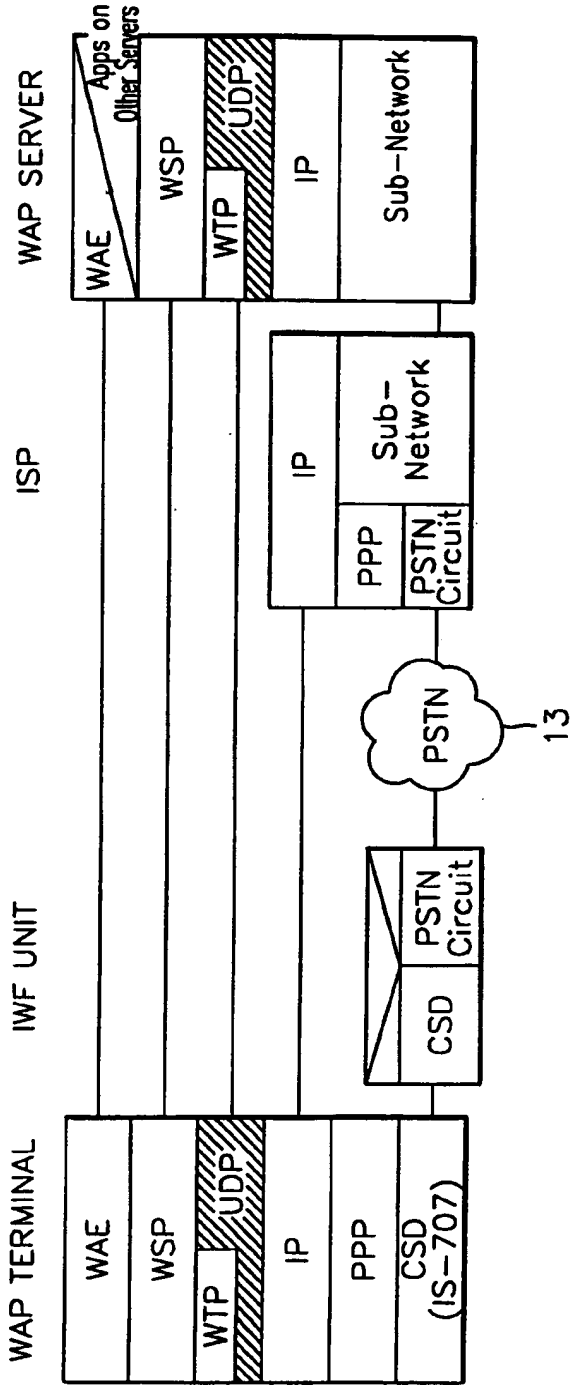


FIG. 3 (PRIOR ART)

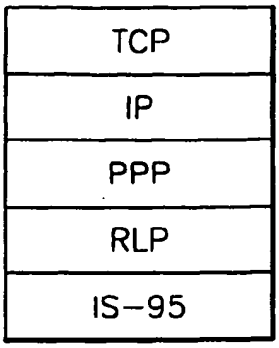


FIG. 4 (PRIOR ART)

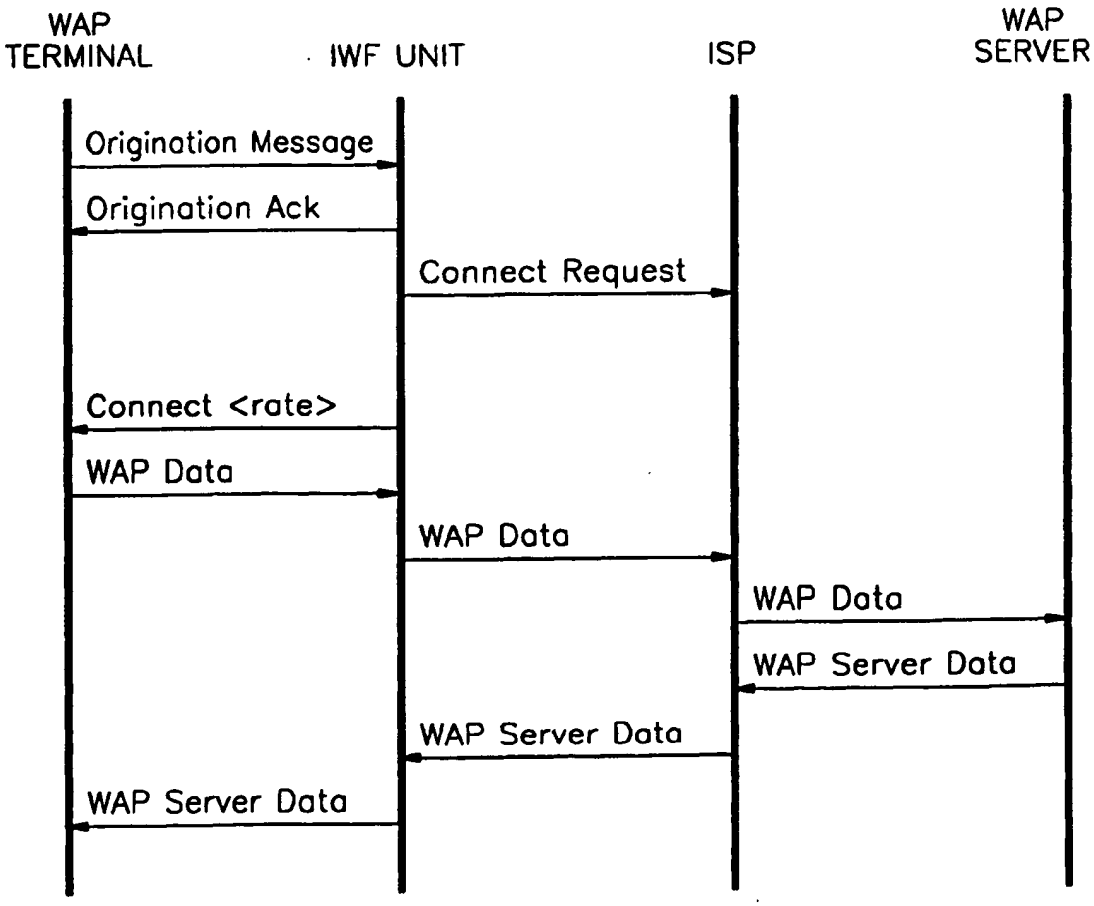


FIG. 5

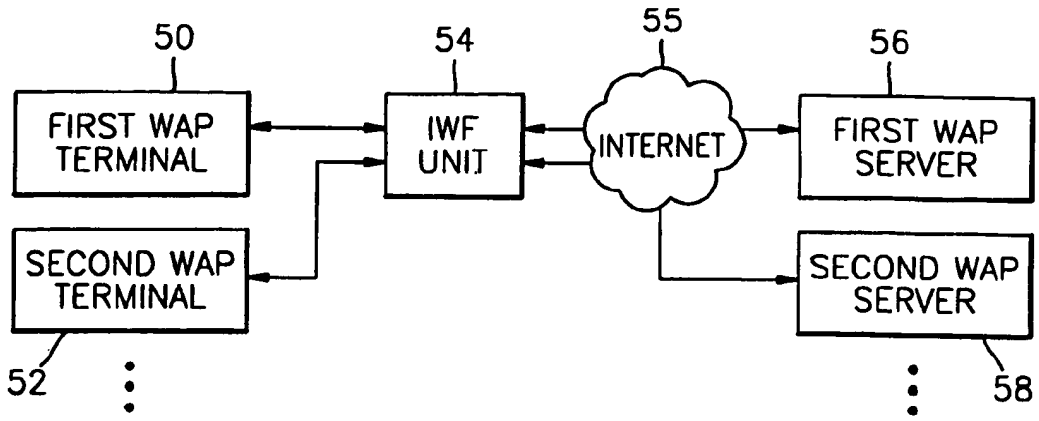

50
54
55
56
FIRST WAP TERMINAL
IWF UNIT
INTERNET
FIRST WAP SERVER
SECOND WAP TERMINAL
SECOND WAP SERVER
52
58

FIG. 7

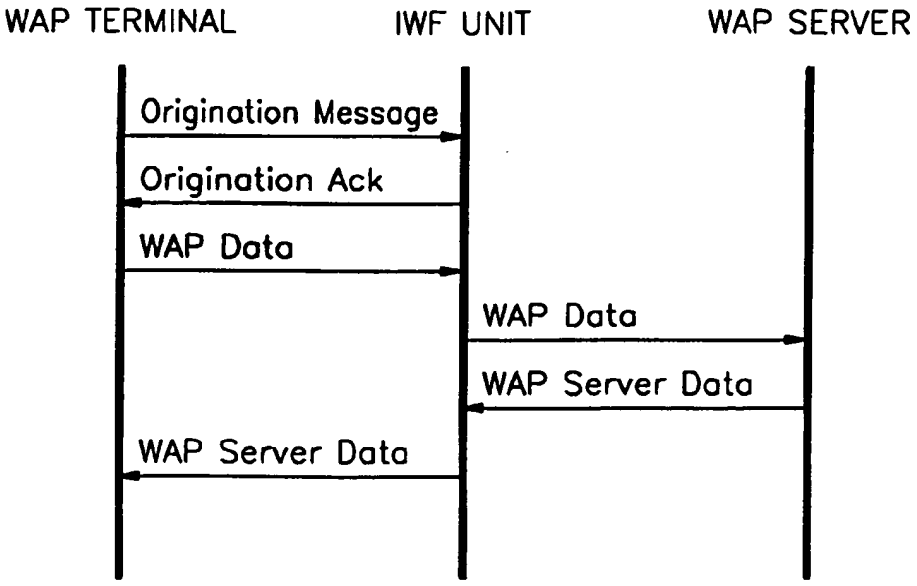

WAP TERMINAL
IWF UNIT
WAP SERVER
Origination Message
Origination Ack
WAP Data
WAP Data
WAP Server Data
WAP Server Data

FIG. 6

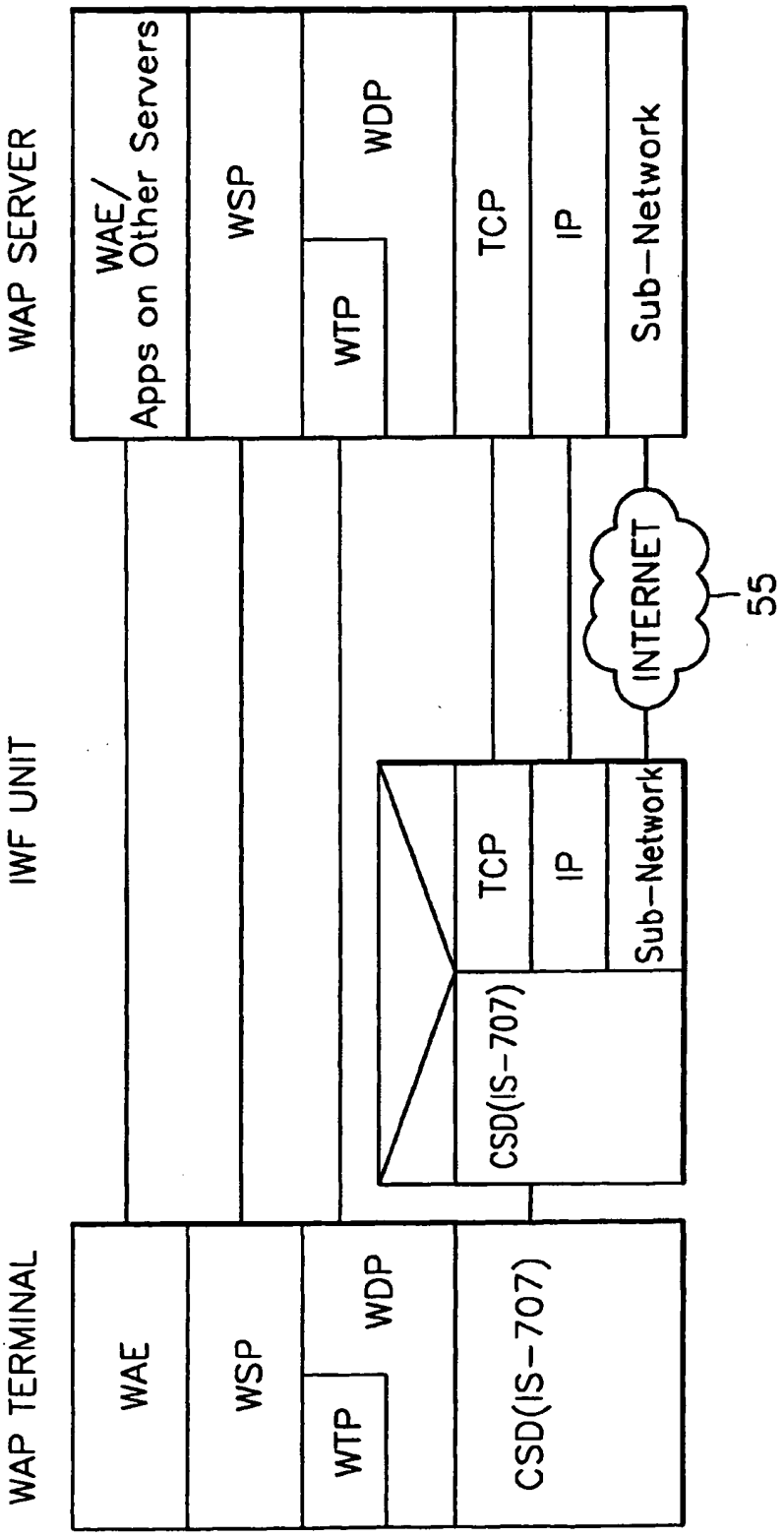

WAP SERVER
WAE/
Apps on Other Servers
WSP
WDP
WTP
TCP
IP
Sub-Network
INTERNET
55
IWF UNIT
TCP
IP
Sub-Network
CSD(IS-707)
WAP TERMINAL
WAE
WSP
WDP
WTP
CSD(IS-707)

FIG. 8

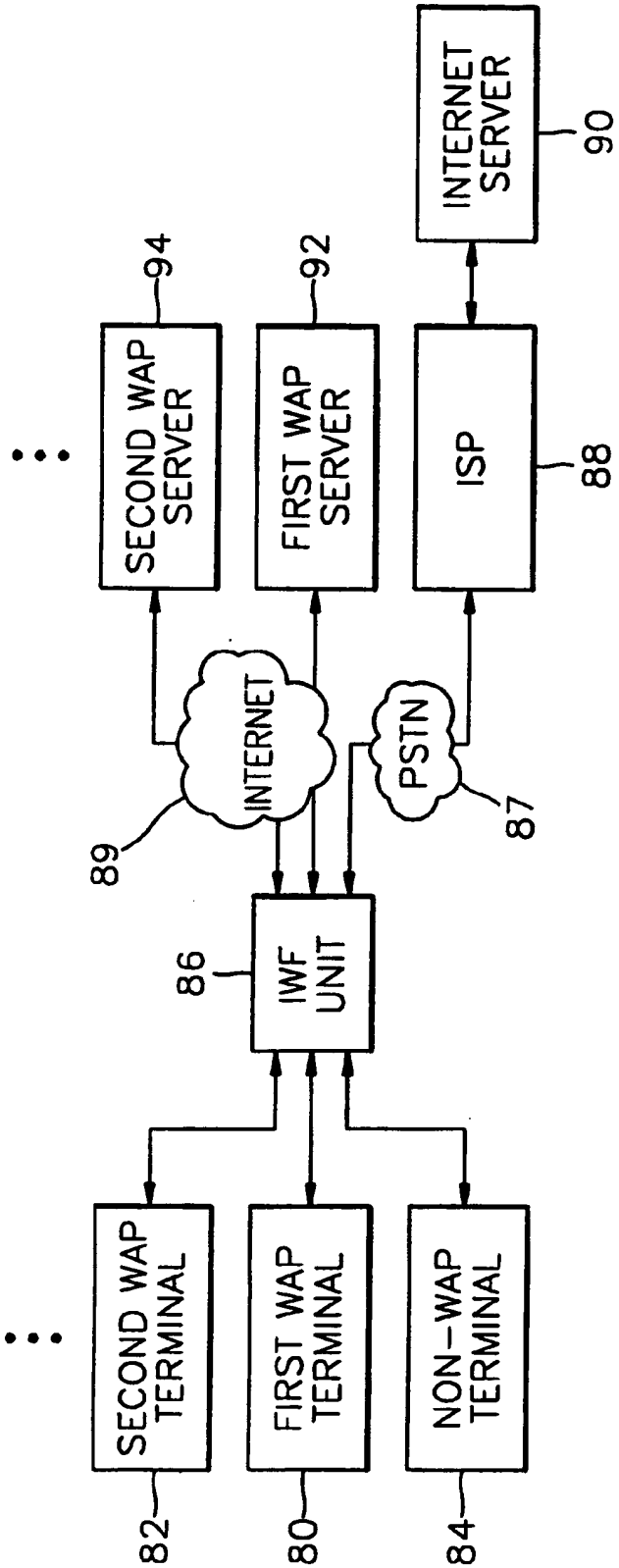
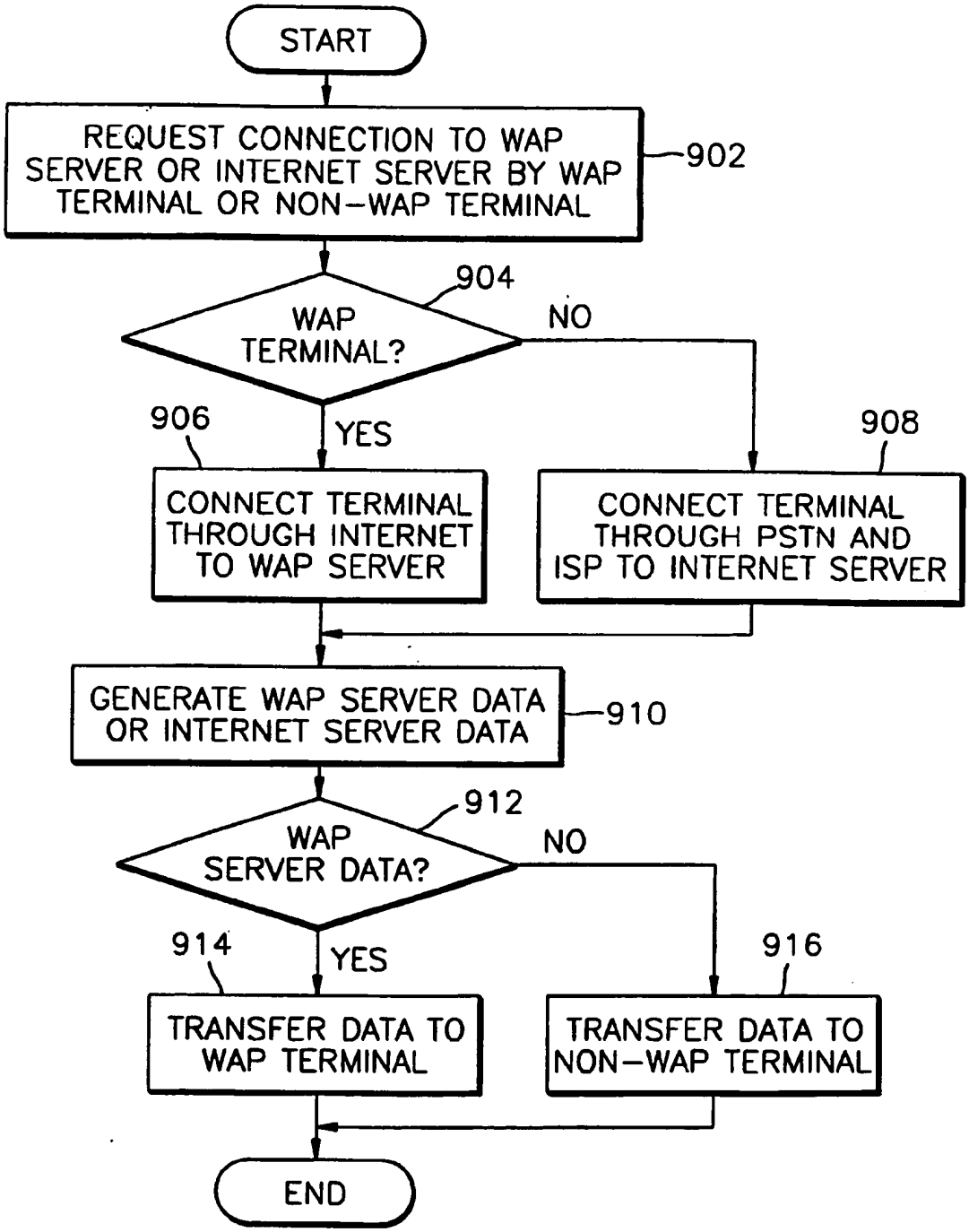

INTERNET SERVER
90
SECOND WAP SERVER
94
FIRST WAP SERVER
92
ISP
88
INTERNET
89
PSTN
87
IWF UNIT
86
SECOND WAP TERMINAL
82
FIRST WAP TERMINAL
80
NON-WAP TERMINAL
84

FIG. 9


START
REQUEST CONNECTION TO WAP SERVER OR INTERNET SERVER BY WAP TERMINAL OR NON-WAP TERMINAL
902
WAP TERMINAL?
904
NO
YES
906
908
CONNECT TERMINAL THROUGH INTERNET TO WAP SERVER
CONNECT TERMINAL THROUGH PSTN AND ISP TO INTERNET SERVER
GENERATE WAP SERVER DATA OR INTERNET SERVER DATA
910
WAP SERVER DATA?
912
NO
YES
914
916
TRANSFER DATA TO WAP TERMINAL
TRANSFER DATA TO NON-WAP TERMINAL
END

DEVICE FOR DATA COMMUNICATIONS BETWEEN WIRELESS APPLICATION PROTOCOL TERMINAL AND WIRELESS APPLICATION SERVER, AND METHOD THEREOF

BACKGROUND OF THE INVENTION

1.Field of the Invention

The present invention relates to data communications, and more particularly, to a device for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server, and a method thereof.

2. Description of the Related Art

In general, a WAP server is connected between an Internet server which provides various information and a WAP terminal capable of receiving the information provided from the Internet server, to convert different data formats and different protocols between the Internet server and the WAP terminal. Also, the WAP server can provide the WAP terminal with its own information.

FIG. **1** is a block diagram of a conventional data communications device between a WAP terminal and a WAP server.

The data communications device of FIG. **1** comprises a WAP terminal **10**, an interworking function (IWF) unit **12**, a public switched telephone network (PSTN) **13**, an Internet service provider (ISP) **14** and a WAP server **16**.

The IWF unit **12** performs routing functions between the WAP terminal **10** and the ISP **14**. The ISP **14** is one of companies providing general communication service such as HITEL or UNITEL. The WAP server **16** provides the WAP terminal **10** with its own information and much information from an Internet server (not shown).

FIG. **2** shows a protocol stack of each block of the data communications device shown in FIG. **1**.

A protocol stack of the WAP terminal **10** consists of a plurality of protocol layers including a Circuit Switch Data services protocol (CSD(IS-707)), a Peer-to-Peer Protocol (PPP), an Internet Protocol (IP), a Wireless Transaction Protocol (WTP) and User Data Program Protocol (UDP), a Wireless Session Protocol (WSP) and a Wireless Application Environment protocol (WAE). Also, the CSD(IS-707) includes an IS-95 protocol, a Radio Link Protocol (RLP), a PPP, an IP and a TCP. The protocol layers are well known to those skilled in the art, so explanation thereof will be omitted.

FIG. **4** is a diagram illustrating data flow in the data communications device shown in FIG. **1**.

The operation of the data communications device of FIG. **1** will be described with reference to FIG. **4**.

It is assumed that the WAP terminal **10** intends to receive Internet or electronic mail (E-mail) services. Here, the WAP terminal **10** is ready to-receive a common call or data (Internet or E-mail) in a normal state. When a user of the WAP terminal **10** connects the WAP terminal **10** through the IWF unit **12** and the PSTN **13** to the ISP **14** using a telephone number for connection with the Internet, the ISP **14** connected to the WAP terminal **10** allows the user to receive the Internet or E-mail services. Also, when the user wants to stop receiving the Internet services, the ISP **14** disconnects the call from the WAP terminal **10**, returning to the ready state.

In detail, the WAP terminal **10** sends an Origination Message requesting connection of its call to the IWF unit **12**.

The IWF unit **12** receives the Origination Message from the WAP terminal **10**, and then sends an Origination Ack message acknowledging reception to the WAP terminal **10**. The IWF unit **12** sends a Connect Request message for connection of a modem to the ISP **14**. The ISP **14** receives the Connect Request message and sends a Connect <rate> message indicating the connection of the modem through the PSTN **13** and the IWF unit **12** to the WAP terminal **10**. Under conditions that the WAP terminal **10** and the IWF unit **12** are connected to each other, the WAP terminal **10** sends WAP data (Internet or E-mail services request data) which the user Wants to receive through the IWF **12** and the ISP **14**, to the WAP server **16**. After the WAP server **16** receives the WAP data, the WAP server **16** sends WAP server data which is retained in the WAP server itself, or data taken from an Internet server (not shown) through the ISP **14**, the PSTN **13** and the IWP **12** to the WAP terminal **10**.

The data communications device of FIG. **1**, having the protocol stack as shown in FIG. **2**, has the following problems.

First, because the CSD(IS-707) in the protocol stack of the WAP terminal **10** includes the IPIPPP as shown in FIG. **3**, the protocol stack of the WAP terminal **10** has IP/PPP protocol layers in duplicate. As a result, there is much overhead during transmission of data, so that transmission efficiency becomes low. That is, the resources of the terminal are not efficiently used. Also, when a user intends to connect to the WAP server **16** or the Internet, connection with the ISP **14** is achieved through the PSTN **14**. Thus, the connection rate becomes slow, and using the PSTN and the ISP **14** may be subject to charges by the telephone company or the ISP. Also, the transmission of data is inefficient because it requires multiple steps as shown in FIG. **4**.

SUMMARY OF THE INVENTION

To solve the above problems, it is a first object of the present invention to provide a device for data communications between a Wireless Application Protocol (WAP) protocol and a WAP server, adopting a protocol stack in which a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer included in a Circuit Switch Data services (ISD) protocol of the WAP terminal is used and an interworking function (IWF) unit also acts as an Internet service provider (ISP).

It is a second object of the present invention to provide a communication method of the data communications device for the first object.

It is a third object of the present invention to provide a device for data communications between a WAP terminal and WAP server, which performs data communications while performing switching between the WAP terminal and a non-WAP terminal.

It is a fourth object of the present invention to provide a communication method of the data communications device for the third object.

Accordingly, to achieve the above first object, there is provided a device for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server, comprising: a plurality of WAP terminals each having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, for generating WAP data which is service request data; a plurality of WAP servers each having a protocol stack in which a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under

a WTP layer and a WDP layer, for providing the WAP terminals with WAP server data according to the WAP data; and an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, for mapping the WAP terminals to the corresponding WAP servers, wherein each WAP terminal communicates with the IWF unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer included in its own CSD protocol layer, and the IWF unit communicates through the Internet with each WAP server.

To achieve the second object, there is provided a communication method of a data communications device including a plurality of WAP terminals having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, a plurality of WAP servers having a protocol stack in which a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under a WTP layer and a WDP layer, and an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, for communications between each WAP terminal and each WAP server, the method comprising the steps of: (a) transferring an Origination Message for a call connection from each WAP terminal to the IWF unit, and transferring an Origination ACK from the IWF unit to the corresponding WAP terminal in response to the Origination Message; (b) receiving WAP data which is service request data for the WAP servers from the WAP terminals, to map each WAP terminal to the corresponding WAP server in the IWF unit, and transferring the received WAP data through the Internet to the corresponding WAP server; (c) receiving the WAP data to generate WAP server data according to the received WAP data in each WAP server, and transferring the WAP server data through the Internet to the IWF unit; (d) receiving the WAP server data transferred in the step (c) to map the WAP servers to the corresponding WAP terminals in the IWF unit, and transferring the received WAP server data to the corresponding WAP terminals; and (e) communicating in the WAP terminals with the IWF unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer contained in each Circuit Switch Data service (CSD) protocol layer of the WAP terminals.

To achieve the third object, there is provided a device for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server, comprising: a plurality of WAP terminals each having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, for generating WAP data which is service request data; a non-WAP terminal for generating a common circuit data; a plurality of WAP servers each having a protocol stack in which at least a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under a WTP layer and a WDP layer, for providing the WAP terminals with WAP server data according to the WAP data; an Internet server for providing the non-WAP terminal with Internet server data according to the common circuit data; an Internet service provider (ISP) having a public switched telephone network (PSTN) circuit layer, for transferring the common circuit data received through a PSTN from the non-WAP terminal, to the Internet server; and an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, for performing interfacing between each WAP terminal and each WAP server, and the non-WAP terminal and the ISP, wherein each WAP terminal communicates with the IWF unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer included in its own CSD protocol layer, and the IWF unit communicates through the Internet with each WAP server.

To achieve the fourth object, there is provided a communication method of a data communications device including a plurality of WAP terminals each having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, a non-WAP terminal for generating a common circuit data, a plurality of WAP servers each having a protocol stack in which at least a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under a WTP layer and a WDP layer, an Internet server for providing the non-WAP terminal with Internet server data according to the common circuit data, an Internet service provider (ISP) having a public switched telephone network (PSTN) circuit layer, for transferring the common circuit data received through a PSTN from the non-WAP terminal to the Internet server, an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, for data communications between each WAP terminal and each WAP server, the method comprising the steps of: (a) determining whether data input to the IWF unit is WAP data or the common circuit data; (b) transferring the WAP data through the Internet to the corresponding WAP server if the input data is determined to be the WAP data in the step (a) and transferring the common circuit data through the ISP to the Internet server if the input data is determined to be the common circuit data in the step (b); (c) determining whether the data input to the IWF unit is WAP server data or the Internet server data; and (d) transferring the WAP server data through the Internet to the corresponding WAP terminal if the input data is determined to be the WAP server data in the step (c), and transferring the Internet server data through the PSTN to the non-WAP terminal if the input data is determined to be the Internet server data in the step (c), wherein each WAP terminal communicates with the IWF unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer included in its own CSD protocol layer.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and advantages of the present invention will become more apparent by describing in detail a preferred embodiment thereof with reference to the attached drawings in which:

FIG. **1** is a block diagram of a conventional device for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server;

FIG. **2** shows protocol stacks of each block of the conventional data communications device;

FIG. **3** is a detailed view of the Circuit Switch Data service protocol (CSD(IS-707) shown in FIG. **2**;

FIG. **4** is a diagram illustrating data flow in the data communications device shown in FIG. **1**;

FIG. **5** is a block diagram of a device for data communications between a WAP terminal and a WAP server according to a preferred embodiment of the present invention;

FIG. 6 shows protocol stacks of each block of the data communications device shown in FIG. 5;

FIG. 7 is a diagram illustrating data flow in the data communications device shown in FIG. 5;

FIG. 8 is a block diagram of a device for data communications between a WAP terminal and a WAP server according to another preferred embodiment of the present invention; and

FIG. 9 is a flowchart illustrating a communication method of the data communications device shown in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 5 showing a device for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server according to a first embodiment of the present invention, the device comprises a plurality of WAP terminals **50, 52,** . . . , and an interworking function (IWF) unit **54**, the Internet **55** and a plurality of WAP servers **56, 58** . . . .

Each WAP terminal **50, 52,** . . . has a protocol stack in which a Circuit Switch Data services protocol (CSD) layer is situated below a Wireless Session Protocol (WSP) layer and a Wireless Datagram Protocol (WDP) layer, and generates WAP data which is data requesting data service from each WAP server **56, 58,** . . .

FIG. 6 shows a protocol stack of one of the WAP terminals **50, 52,** . . . The protocol stack of FIG. 6 is different from that of the conventional WAP terminal of FIG. 2 in that only a CSD(IS-707) layer exists below the WTP and WOP layers and the IP and PPP layers are omitted. That is, because the CSD(IS-707) layer itself includes the IP and PPP layers as described with reference to FIG. 3, the WAP terminal according to the present invention utilizes the IP and PPP layers of the CSD(IS-707), without having IP and PPP layers therein, such that there is no redundant IP and PPP layers unlike the conventional protocol stack. Each WAP terminal **50, 52,** . . . has a unique identification number or source IP address.

Each WAP server **56, 58,** . . . has a protocol stack in which a CSD layer exists below a WTP layer and a WDP layer, and a Transmission Control Protocol (TCP) layer and an IP layer exist, and provides the WAP terminals **50, 52,** . . . with WAP server data according to the WAP data provided. As shown in FIG. 6, a protocol stack of each WAP server **56, 58,** . . . has a corresponding structure for each WAP terminal **50, 52,** . . . The WAP server of FIG. 6 is different from the conventional WAP server in that it comprises the TCP layer which is not shown in the conventional WAP server. Each WAP server **56, 58,** . . . has an identification number or a destination IP address for each source IP address of the WAP terminals **50, 52,** . . . .

The IWF unit **54** comprises a CSD protocol layer connected to each CSD protocol layer of the WAP terminals, and TCP and IP layers each connected to the TCP and IP layers of each WAP server, to map the WAP terminals **50, 52,** . . . to the corresponding WAP servers **56, 58,** . . . Here, the identification number of a specific WAP terminal may be mapped to a destination IP address of the corresponding WAP server, or a source IP address of the WAP terminal is mapped to a specific mapping table value. To this end, the IWF unit **54** has a mapping table (not shown) used for connecting the identification number of a specific WAP terminal to a WAP server. The IWF unit **54** also includes another mapping table (not shown) which is used for finding the corresponding WAP terminal during reception of data from a WAP server. The IWF unit **54** and the WAP servers **56, 58,** . . . are connected through the Internet **55**.

FIG. 7 is a diagram illustrating data flow in the data communications device shown in FIG. 5.

When the WAP terminals **50, 52,** . . . send an Origination Message for a call connection thereof to the IWF unit **12**, the IWF unit **12** receives the Origination message and then sends an Origination Ack message as a confirmation of the reception to the WAP terminals **50, 52,** . . . When one of the WAP terminals **50, 52,** . . . receives the Origination Ack message, the WAP terminals **50, 52,** . . . being connected to the corresponding WAP servers **56, 58,** . . ., send a WAP data which is service request data through the Internet **55** to the WAP servers **56, 58,** . . . After receiving the WAP data, the WAP servers **56, 58,** . . . send WAP server data which they retain, or data transferred from an Internet server (not shown) through the Internet **55** and the IWF unit **54** to the WAP terminals **50, 52,** . . . That is, the WAP terminals **50, 52,** . . . are directly connected to the WAP servers without going through an Internet service provider (ISP) using a public switched telephone network (PSTN).

FIG. 8 is a block diagram of a data connection device for communications between a WAP terminal and a WAP server according to another embodiment of the present invention.

The data connection device of FIG. 8 comprises WAP terminals **80, 82,** . . . , a non-WAP terminal **84**, an IWF unit **86**, a PSTN **87**, an ISP **88**, the Internet **89**, an Internet server **90**, and WAP servers **92, 94,** . . .

Each WAP terminal **80, 82,** . . . has a protocol stack in which a CSD protocol is layer resides below WTP and WDP layers, and generates WAP data for requesting data service to the WAP servers **92, 94,** . . . Each WAP terminal **80, 82,** . . . has a unique identification number or source IP address.

The non-WAP terminal **84** generates a common circuit data.

Each WAP server **92, 94,** . . . has a protocol stack in which TCP and IP layers **20** are situated below WTP and WDP layers, and provides the WAP terminals **80, 82,** . . . with WAP server data according to the WAP data. Each WAP server **92, 94,** . . . has an identification number or a destination IP address corresponding to each source IP address of the WAP terminals **80, 82,** . . .

The ISP **88** includes a PSTN circuit layer connected to a PSTN circuit layer of the IWF unit **86** to be described later, receives the common circuit data of the non-WAP terminal **84** through the PSTN **87** and transfers the received data to the Internet server **90**. The ISP **88** is one of the companies providing general communication services to a common carrier.

The Internet server **90** provides the non-WAP terminal **84** with Internet server data in response to the common circuit data.

The IWF unit **86** includes a CSD protocol layer, TCP and IP layers and a PSTN circuit layer, and acts as interfaces between the WAP terminals **80, 82,** . . . and WAP servers **92, 94,** . . . , and between the non-WAP terminal **84** and the ISP **88**. The IWF unit **86** is connected through the Internet **89** to the WAP servers **92, 94**, and the IWF unit **86** and the ISP **88** are connected to each other through the PSTN **87**. The CSD protocol layer is connected to each CSD protocol layer of the WAP terminals **80, 82,** . . . , and the TCP and IP layers are connected respectively to the TCP and IP layers of each of the WAP servers **92, 94** . . . Also, the PSTN circuit layer is connected through the PSTN **87** to the PSTN circuit layer of the ISP **88**. In detail, when an input data is the WAP data or

the WAP server data, interfacing is performed such that an identification number of the WAP terminal is mapped to a destination IP address of the WAP server, or a source IP address of the WAP terminal is mapped to a specific mapping table value. Meanwhile, when an input data is the common circuit data or the Internet server data, interfacing between the non-WAP terminal **82** and the ISP **86** is performed.

FIG. **9** is a flowchart illustrating a data communication method between a WAP terminal and a WAP server according to another embodiment of the present invention.

One of the WAP terminals **80, 82,** . . . or the non-WAP terminal **84** requests connection to one of the WAP servers **92, 94,** . . . or the Internet server **90** (step **902**). That is, one WAP terminal or the non-WAP terminal **84** generates a WAP data or common circuit data, respectively, and transfers the data to the IWF unit **86**.

The IWF unit **86** determines whether or not the terminal that needs to be connected in step **902** is a WAP terminal, based on the WAP data or the common circuit data (step **904**)

If the connection request terminal is a WAP terminal, the WAP terminal is connected through the Internet **89** to the WAP server (step **906**). Meanwhile, if the connection request terminal is not a WAP terminal but a non-WAP terminal, the non-WAP terminal is connected through the PSTN **87** to the ISP **88**, and then to the Internet server **90** (step **908**).

The WAP server **92** and the Internet server **90** generate WAP server data and Internet server data, respectively, and transfer respective data through the Internet **89**, or the ISP **88** and the PSTN **87** to the IWF unit **86**.

The IWF unit **86** determines whether or not the input data is WAP server data (step **912**).

When the input data is from a WAP server, the data is transferred to the WAP terminal. Meanwhile, when the input data is Internet server data, the data is transferred to the non-WAP terminal **84**.

The invention may be embodied in a general purpose digital computer that is running a program from a computer usable medium, including but not limited to storage media such as magnetic storage media (e.g., ROM's, floppy disks, hard disks, etc.), optically readable media (e.g., CD-ROMs, DVDs, etc.) and carrier waves (e.g., transmissions over the Internet).

Hence, the present invention may be embodied as a computer usable medium having a computer readable program code unit embodied therein for communications between a WAP terminal and a WAP server of a data communications device including a plurality of WAP terminals having a protocol stack in which a CSD protocol layer is laid under a WTP layer and a WDP layer, a plurality of WAP servers having a protocol stack in which a TCP layer and an IP layer are laid under a WTP layer and a WDP layer, and an IWF unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, wherein each WAP terminal communicates through a single IP/PPP protocol layer included in its own CSD protocol layer to the IWF unit, the computer readable program code means in the computer usable medium comprising: computer readable program code means for causing a computer to effect transferring an Origination Message for a call connection from each WAP terminal to the IWF unit, and transferring an Origination ACK from the IWF unit to the corresponding WAP terminal in response to the Origination Message; computer readable program code means for causing a computer to effect receiving WAP data which is service request data for the WAP servers from the WAP terminals, to map each WAP terminal to the corresponding WAP server in the IWF unit, and transferring the received WAP data through the Internet to the corresponding WAP server; computer readable program code means for causing a computer to effect receiving the WAP data to generate WAP server data according to the received WAP data in each WAP server, and transferring the WAP server data through the Internet to the IWF unit; computer readable program code means for causing a computer to effect receiving the WAP server data transferred in the step (c) to map the WAP servers to the corresponding WAP terminal in the IWF unit, and transferring the received WAP server data to the corresponding WAP terminals; and computer readable program code means for causing a computer to effect communicating in the WAP terminals with the IWP unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer contained in each Circuit Switch Data service (CSD) protocol layer of the WAP terminals, for instance.

Also, the present invention may be embodied as a computer usable medium having a computer readable program code unit embodied therein for communications transferred between a WAP terminal and a WAP server of a data communications device including a plurality of WAP terminals each having a protocol stack in which a CSD protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a WDP layer, a non-WAP terminal for generating a common circuit data, a plurality of WAP servers each having a protocol stack in which at least a TCP layer and an IP layer are laid under a WTP layer and a WDP layer, an Internet server for providing the non-WAP terminal with Internet server data according to the common circuit data, an ISP having a PSTN circuit layer, for transferring the common circuit data received through a PSTN from the non-WAP terminal, to the Internet server, an IWF unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, wherein each WAP terminal communicates through a single IP/PPP protocol layer included in its own CSD protocol layer to the IWF unit, the computer readable program code means in the computer usable medium comprising: computer readable program code means for causing a computer to effect determining whether data input to the IWF unit is WAP data or the common circuit data; computer readable program code means for causing a computer to effect transferring the WAP data through the Internet to the corresponding WAP server if the input data is determined as the WAP data and transferring the common circuit data through the ISP to the Internet server if the input data is determined to be the common circuit data; computer readable program code means for causing a computer to effect determining whether the data input to the IWF unit is WAP server data or the Internet server data; and computer readable program code means for causing a computer to effect transferring the WAP server data through the Internet to the corresponding WAP terminal if the input data is determined to be the WAP server data, and transferring the Internet server data through the PSTN to the non-WAP terminal if the input data is determined to be the Internet server data, for instance.

A functional program, code and code segments, used to implement the present invention can be derived by a skilled computer programmer from the description of the invention contained herein.

While the present invention has been illustrated and described with reference to specific embodiments, further

modifications and alterations within the spirit and scope of this invention as defined by the appended claims will occur to those skilled in the art.

As described above, the data communications device according to the present invention adopts a protocol stack in which only a single IP/PPP protocol layer resides in the WAP terminals and the IWF unit functions as an ISP, providing the following effects. First, because there is no redundancy of IP/PPP protocol layers in the WAP terminal, overhead is considerably reduced compared to the conventional data transmission. Second, the IWF unit is directly connected through the Internet to the WAP server, not through the PSTN and the ISP, so that connection time and costs can be reduced. Third, the data flow procedure is also simplified compared to the conventional data communications device and method thereof.

What is claimed is:

1. A system for data communications between a Wireless Application Protocol (WAP) terminal and a WAP server, comprising:

a plurality of WAP terminals each having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, for generating WAP data which is service request data;

a plurality of WAP servers each having a protocol stack in which a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under a WTP layer and a WDP layer, for providing the WAP terminals with WAP server data according to the WAP data; and

an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layer of each of the WAP terminals, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, for mapping the WAP terminals to corresponding one of the WAP servers,

wherein each of the WAP terminals communicates with the IWF unit though a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer included in its own CSD protocol layer, and the IWF unit communicates through the Internet with each of the WAP servers.

2. The device of claim 1, wherein the IWF unit includes a mapping table used for mapping each of the WAP terminals to a corresponding one of the WAP servers,

wherein identification numbers of each of the WAP terminals and destination IP addresses of each of the WAP servers are mapped to each other, or source IP addresses of each of the WAP terminals are mapped to corresponding mapping table values.

3. A communication method of a data communications system including a plurality of WAP terminals having a protocol stack in which a Circuit Switch Data service (CSD) protocol layer is laid under a Wireless Transaction Protocol (WTP) layer and a Wireless Datagram Protocol (WDP) layer, a plurality of WAP servers having a protocol stack in which a Transmission Control Protocol (TCP) layer and an Internet Protocol (IP) layer are laid under a WTP layer and a WDP layer, and an interworking function (IWF) unit having a CSD protocol layer connected to the CSD protocol layers of each of the WAP terminals, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each of the WAP servers, for communications between each of the WAP terminals and each of the WAP servers, the method comprising the steps of:

(a) transferring an Origination Message for a call connection from each of the WAP terminals to the IWF unit, and transferring an Origination ACK from the IWF unit to a corresponding one of the WAP terminals in response to the Origination Message;

(b) receiving WAP data which is service request data for the WAP servers from the WAP terminals, to map each of the WAP terminals to a corresponding one of the WAP servers in the IWF unit, and transferring the received WAP data through the Internet to the corresponding one of the WAP servers;

(c) receiving the WAP data to generate WAP server data according to the received WAP data in each of the WAP servers, and transferring the WAP server data through the Internet to the IWF unit;

(d) receiving the WAP server data transferred in the step (c) to map the WAP servers to corresponding ones of the WAP terminals in the IWF unit, and transferring the received WAP server data to the corresponding one of the WAP terminals; and

(e) communicating in the WAP terminals with the IWF unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer contained in each Circuit Switch Data service (CSD) protocol layer of the WAP terminals.

4. A computer usable medium having a computer readable program code unit embodied therein for communications between a WAP terminal and a WAP server of a data communications device including a plurality of WAP terminals having a protocol stack in which a CSD protocol layer is laid under a WTP layer and a WDP layer, a plurality of WAP servers having a protocol stack in which a TCP layer and an IP layer are laid under a WTP layer and a WDP layer, and an IWF unit having a CSD protocol layer connected to the CSD protocol layers of each WAP terminal, and a TCP layer and an IP layer which are connected to the TCP and IP layers of each WAP server, wherein each of the WAP terminal communicates through a single IP/PPP protocol layer included in its own CSD protocol layer to the IWF unit, the computer readable program code means in the computer usable medium comprising:

first computer readable program code means for causing a computer to effect transferring an Origination Message for a call connection from each of the WAP terminals to the IWF unit, and transferring an Origination ACK from the IWF unit to a corresponding one of the WAP terminals in response to the Origination Message;

second computer readable program code means for causing the computer to effect receiving WAP data which is service request data for the WAP servers from the WAP terminals, to map each of the WAP terminals to a corresponding one of the WAP servers in the IWF unit, and transferring the received WAP data through the Internet to the corresponding one of the WAP servers;

third computer readable program code means for causing the computer to effect receiving the WAP data to generate WAP server data according to the received WAP data in each of the WAP servers, and transferring the WAP server data through the Internet to the IWF unit;

fourth computer readable program code means for causing the computer to effect receiving the WAP server data transferred by the third computer readable program code means to map the WAP servers to the corresponding one of the WAP terminals in the IWF

unit, and transferring the received WAP server data to the one of the WAP terminals; and

fifth computer readable program code means for causing the computer to effect communicating in the WAP terminals with the IWP unit through a single Internet Protocol/Peer-to-Peer Protocol (IP/PPP) layer contained in each Circuit Switch Data service (CSD) protocol layer of the WAP terminals.

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